

May 25, 2001  
NG-01-0709

Office of Nuclear Reactor Regulation  
U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
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Washington, D.C. 20555-0001

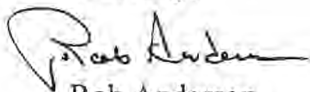
Subject: Duane Arnold Energy Center  
Docket No: 50-331  
Op. License No: DPR-49  
Licensee Event Report #2000-002-01  
File: A-120

Dear Sirs:

Please find attached the subject revision to a Licensee Event Report (LER) submitted in accordance with 10CFR50.73. A recent review of data from this event indicated higher peak reactor pressures existed than initially reported in the original LER. The assessment of safety consequences of the event has not changed. The revision also includes an update to the status of one corrective action.

No new commitments are contained within this revised report. Should you have any questions regarding this revised report, please contact this office.

Sincerely,



Rob Anderson,  
Plant Manager - Nuclear

cc: Mr. James Dyer  
Regional Administrator, Region III  
U. S. Nuclear Regulatory Commission  
801 Warrenville Road  
Lisle, IL 60532

NRC Resident Inspector - DAEC  
DOCU

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## LICENSEE EVENT REPORT (LER)

(See reverse for required number of  
digits/characters for each block)

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503. If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

FACILITY NAME (1)

Duane Arnold Energy Center

DOCKET NUMBER (2)

05000331

PAGE (3)

1 OF 4

TITLE (4)

Turbine Trip and Reactor Scram Due to Main Generator Lockout

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
06	23	2000	2000	002	01	05	25	2001	FACILITY NAME	DOCKET NUMBER
OPERATING MODE		1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
POWER LEVEL (10)		100	20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)(B)		50.73(a)(2)(viii)	
			20.2203(a)(1)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)	
			20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71	
			20.2203(a)(2)(ii)		20.2203(a)(4)		X 50.73(a)(2)(iv)		OTHER	
			20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)(C)		Specify in Abstract below or in RC Form 366A	
20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)						

## LICENSEE CONTACT FOR THIS LER (12)

NAME

Leonard Sueper, Principal Licensing Engineer

TELEPHONE NUMBER (Include Area Code)

(715) 377-3352

## COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
X	EL	SCT	G080	N					

## SUPPLEMENTAL REPORT EXPECTED (14)

## EXPECTED

## SUBMISSION DATE

MONTH

DAY

YEAR

YES

(If yes, complete EXPECTED SUBMISSION DATE).

X

NO

## ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On June 23, 2000 at 1616, with the reactor operating at 100% power, the Duane Arnold Energy Center (DAEC) experienced a main generator lockout which caused a turbine trip and reactor scram. The plant and control room operator responses were as expected. The safety consequences were minimal.

The cause of the event was a main generator backup lockout due to a unit differential current trip. Initial testing on the associated current transformers did not indicate the existence of equipment malfunction. Other potential causes of the transient, including lightning strike, were investigated and additional equipment walk downs and testing were performed. No definitive cause was determined. During the subsequent plant startup the generator output current transformer, which provides an input to the unit differential current relay, failed approximately 30 minutes after the generator was synchronized to the grid. Apparently, a loose connection on one of the current transformer secondary leads caused an increased voltage potential, which resulted in an arc that destroyed the lead.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

I. DESCRIPTION OF EVENT:

On June 23, 2000 at 1616, with the reactor operating at 100% power, the Duane Arnold Energy Center (DAEC) experienced a generator lockout due to a trip of a Plant Unit Differential Current relay (378/U-03). This, in turn, caused a turbine trip, reactor scram, and an End-of-Cycle recirculation pump trip (EOC-RPT) of both reactor recirculation pumps. Four safety-relief valves lifted briefly to limit reactor pressure to a peak of approximately 1,115 psig. Primary containment isolation system valves (PCIS Group II, III, and IV) also closed. Reactor vessel level reached a low of 164 inches above the top of active fuel (TAF) during the initial void collapse. Vessel level reached 211 inches above TAF during level recovery, which caused the running 'B' reactor feedwater pump to trip on high level. The feedwater pump was restarted when the high level trip was reset.

II. CAUSE OF EVENT

The scram was caused by a main generator backup lockout differential current trip actuated by relay 378/U-03. Following the scram, resistance, megger and excitation testing was conducted on the three current transformers, which provide an input to 378/U-03. The testing indicated the current transformers were functional and no anomalies were detected. Because a thunderstorm had passed through the area approximately two hours earlier, the possibility that a lightning strike had produced a grid disturbance was also investigated. Walkdowns of the switchyard and main transformer areas were conducted and testing was performed on the iso-phase and main transformer lightning arrestors. No conclusive evidence was found supporting the hypothesis of a lightning strike. The calibration of relay 378/U-03 was checked and found satisfactory.

Temporary data recorders were installed on the inputs to relay 378/U-03 and monitored during the subsequent reactor startup. Approximately 30 minutes after the generator was synchronized to the grid, the output from the main generator current transformer failed suddenly (Note: the generator output at the time was insufficient to cause 378/U-03 to pick up). The generator was then manually tripped and the current transformer was inspected. One of the leads from the current transformer secondary was found destroyed. The mechanical cause of the failed lead was a loose terminal connection or inadequate wire crimp on the terminal lug.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

A loose connection would have allowed large voltage potentials to develop in the current transformer secondary, which apparently resulted in a brief arc. The arc caused an indicated current mismatch, which initiated the generator lockout. However, the duration of the arc was insufficient to destroy the lead and electrical continuity remained during the post-scrum diagnostic testing. Because the generator output was held at a low level during the subsequent plant restart, the output of the current transformer was insufficient to allow 378/U-3 to trip but permitted a large voltage potential to redevelop. Arcing then continued uninterrupted until the lead was destroyed.

Maintenance had last been performed on the current transformers in 1998 to temporarily install shorting links across the secondary leads during generator testing.

III. ANALYSIS OF EVENT:

Reactor vessel pressure and level were maintained within safe operating limits during the transient. The plant response was consistent with a turbine control valve fast closure event at rated power with turbine bypass capability (reference DAEC Updated Final Safety Analysis Report section 15.2.1.1) including the brief lifting of safety-relief valves. All control rods inserted upon receipt of the scram signal. The generator lockout, turbine trip, and reactor scram were the result of a sensed differential current condition between the generator output and the sum of the auxiliary transformer and 'H' and 'I' breaker inputs. No valid generator lockout condition existed. The feedwater pump trip on high vessel level is normal following a reactor scram. The feedwater pump was restarted without incident. There were no safety consequences impacting plant or public safety as a result of this event. The actions taken by the operators were appropriate.



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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

IV. CORRECTIVE ACTIONS:

The failed current transformer was replaced. Although the tightness of the connections on the generator neutral and line site current transformers was verified, the lockwashers on the connections were replaced.

Industry and in-house operating experience was reviewed as well as vendor manual recommendations. System walkdowns and component testing were conducted immediately following the scram (see below). Temporary data recorders were installed during plant startup to monitor equipment performance.

An evaluation has been performed and a preventive maintenance task initiated to conduct periodic checks of terminal connection tightness on main generator current transformers.

V. ADDITIONAL INFORMATION:

A. Previous Similar Events

LER 331-89011 refers to the failure of a different current transformer; however, the root cause of that event was later determined to be a failed trip coil on a circuit breaker. The cause of the current transformer failure was not described. Comparable generator trips that were due to inadequate electrical connections in current transformers include scrams at Quad Cities-2 (LER 265-98003) and Grand Gulf (416-95010).

B. Failed Component

General Electric gas cooled high-voltage bushing and current transformer, catalog no. 1B985/1B995. These are passive devices that do not require periodic maintenance per the manufacturer. No other significant maintenance history at DAEC was found for these components.

This report is being submitted pursuant to 10CFR50.73(a)(2)(iv).

Corrective action program document(s): AR# 20519